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NEW ENGLAND DIV APR 79

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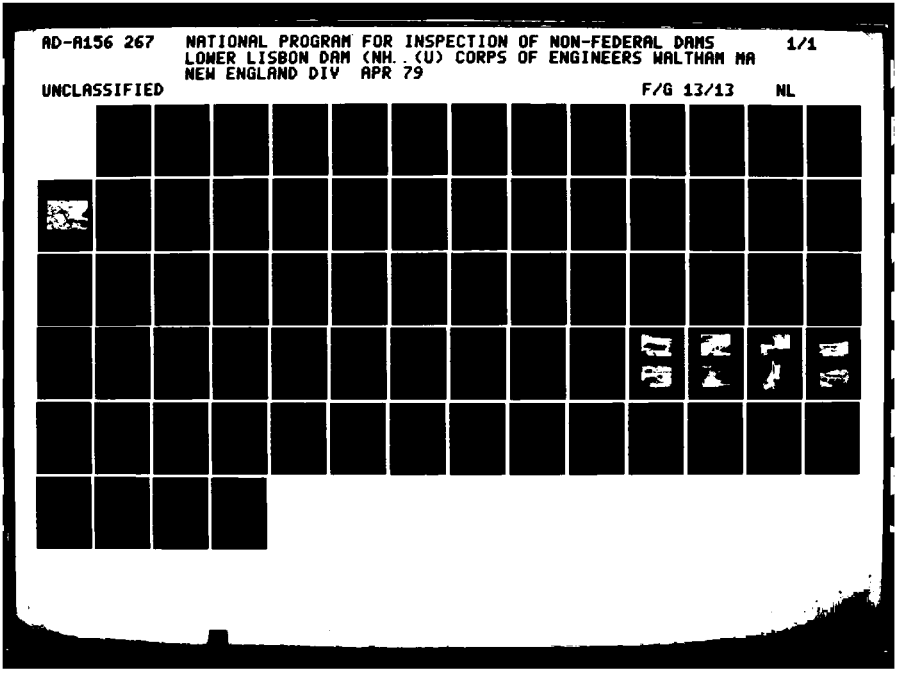

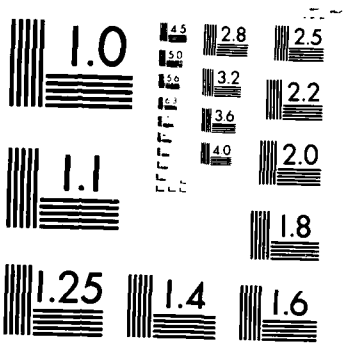

CONNECTICUT RIVER BASIN
LISBON NEW HAMPSHIRE

LOWER LISBON DAM
N.H. 00144

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

APRIL 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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Connecticut River Basin
Lisbon, New Hampshire
Ammonoosuc River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a 300 ft. long, 24 ft. high, run of the river, solid concrete gravity dam set on an irregular bedrock foundation. It is small in size with a low hazard potential. The dam is judged to be in good condition. However, some features could not be observed because of water flowing over the overflow section of the dam. There is some spalling of concrete at the waste gate end of the downstream face of the overflow.

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424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

NOV 1 9 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

Inclosed is a copy of the Lower Lisbon Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, Public Service Company of New Hampshire.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely,

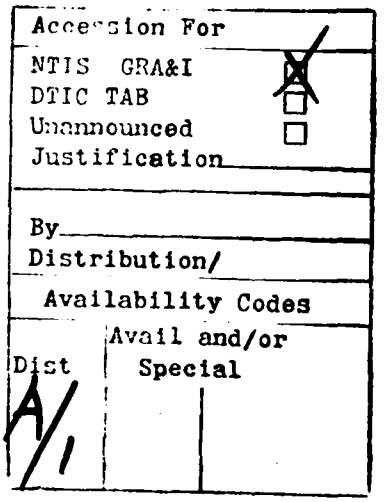
MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

LOWER LISBON DAM

NH00144

LISBON, NEW HAMPSHIRE



PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No:	NH 00144
Name of Dam:	Lower Lisbon Dam
Town:	Lisbon
County and State:	Grafton County, New Hampshire
Stream:	Ammonoosuc River
Date of Inspection:	November 15, 1978

BRIEF ASSESSMENT

The Lower Lisbon Dam is a 300-feet long, 24-feet high run-of-the-river, solid concrete gravity dam set on an irregular bedrock foundation. The dam is presently not being used with the possible exception of ice jam control during the spring run-off period. The drainage area for the dam is 288 square miles and the normal impoundment is 96 acre-feet.

The dam is classified as small with a low hazard potential in the event of a dam failure. Based on size and hazard classifications, a 100-year flood of 33,500 CFS was used as the test flood. Because of the limited storage capacity, the test flood inflow was equal to the test flood outflow. The total spillway capacity of 28,500 CFS is 85.1 percent of the test flood. The test flood would result in an overtopping of the left abutment of approximately one foot. Overbank flow along the left upstream bank in a commercial area would amount to 3 or 4 feet.

The dam is judged to be in good condition, However, some features could not be observed because of water flowing over the overflow section of the dam. The following significant findings were determined during the investigation:

1. The dam is in good overall condition.

2. There is some spalling of concrete at the waste gate end of the downstream face of the overflow section.

3. The impoundment has undergone considerable siltation since its original construction.

It is recommended that the following actions be taken under the guidance of a qualified engineer within one year of the receipt of this report:

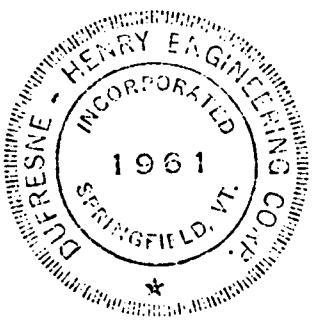
1. Inspect the condition of the concrete when no water is flowing over the dam.

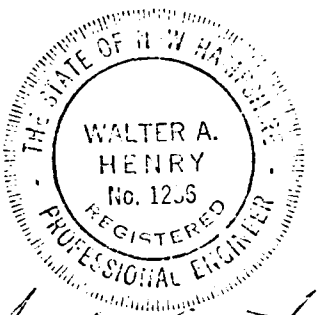
2. Inspect the drain outlet and estimate flow quantity and turbidity when no water is flowing over the dam.

It is further recommended that the following actions be taken under the guidance of a qualified engineer within two years of the receipt of this report:

1. Repair spalled concrete on the waste gate training walls.

2. Institute a program of biennial periodic technical inspection.





Walter A. Henry

This Phase I Inspection Report on Lower Lisbon Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Joseph W. Finegan

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

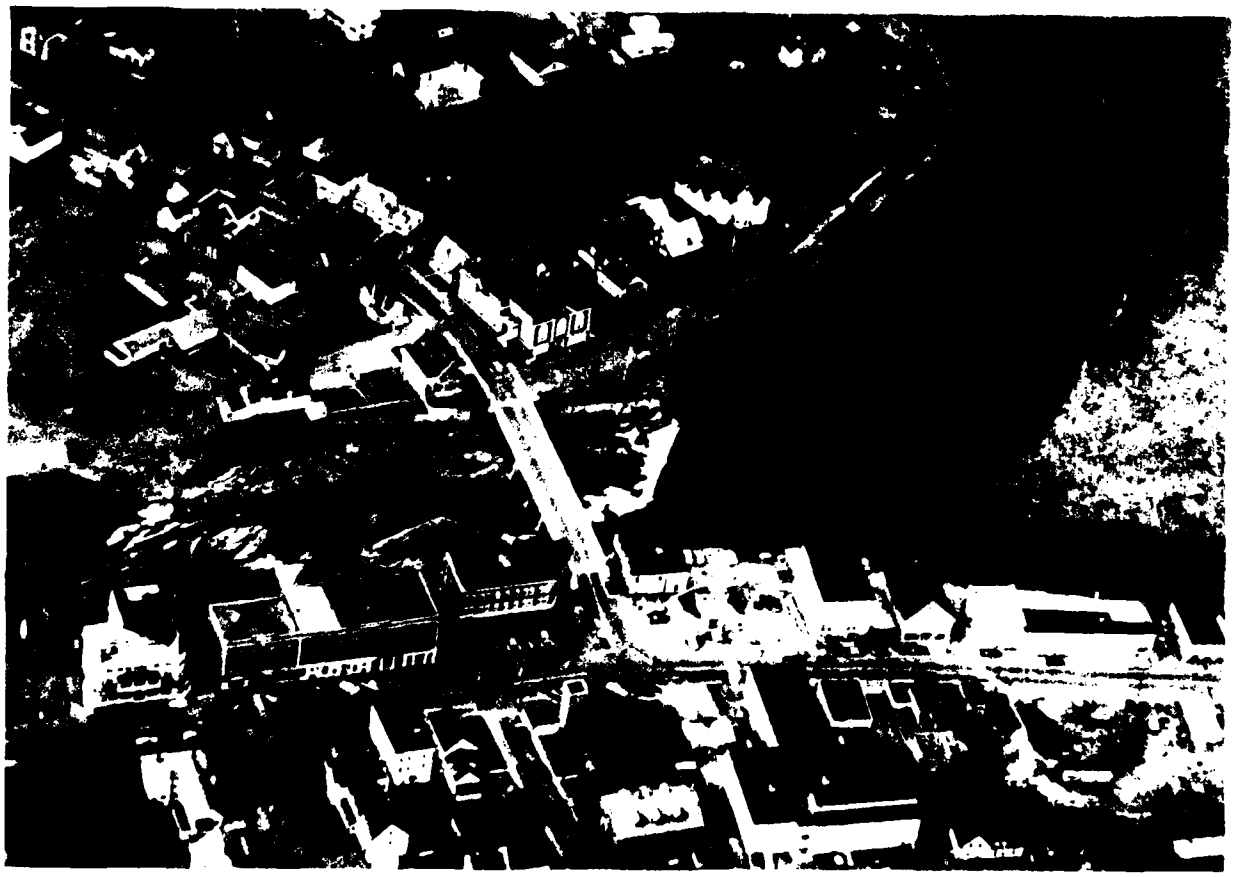
In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

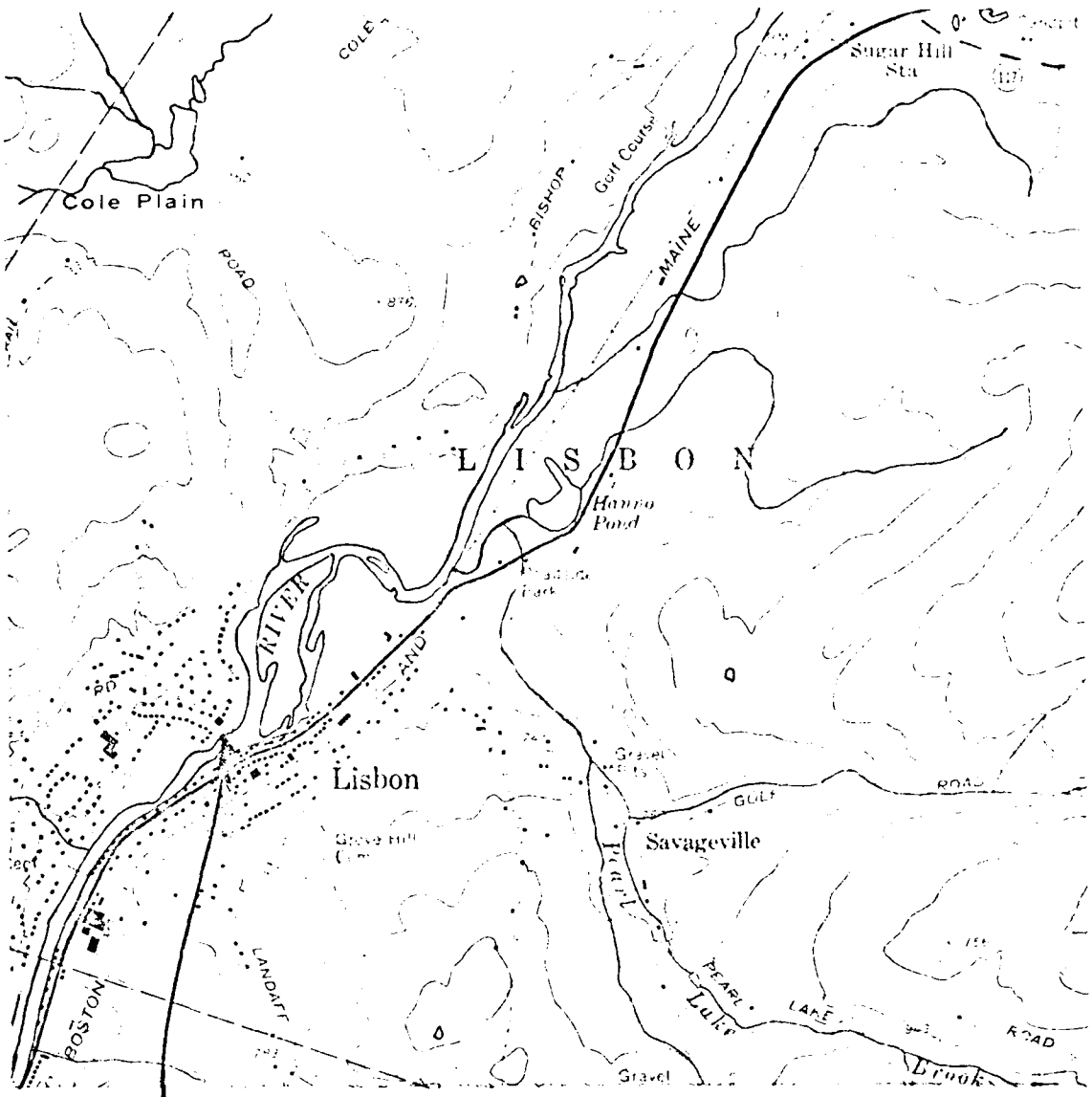
APPENDICES



OVERVIEW OF

LOWER LISBON DAM

LISBON, NEW HAMPSHIRE



SOURCE:
USGS QUADRANGLE
LISBON, N.H.
1:24000 1964

DUFRESNE-HENRY ENGINEERING CORP. ARCHITECT-ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION MAP
LOWER LISBON DAM

LISBON NEW HAMPSHIRE

CHECKED NO.	04-0086		SCALE 1" = 1 MILE
DRAWN	JAD		DATE 4-12-79

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
NAME OF DAM: LOWER LISBON

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Dufresne-Henry Engineering Corporation has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Dufresne-Henry Engineering Corporation under a letter of November 20, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0010 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by nonfederal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for nonfederal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

The Lower Lisbon Dam is located in the Town of Lisbon on the Ammonoosuc River at 44°12.9' north latitude and 71°51.8' west longitude. The dam is in the center of town, immediately upstream of the School Street Bridge across the Ammonoosuc River.

b. Description of Dam and Appurtenances

The dam is a concrete gravity run-of-the-river dam with an overall length of 300 feet and a maximum height of 24 feet. The former power house and headrace canal located on the

left side of the dam have been abandoned and filled. A single waste gate is located just upstream of the old head gates and canal.

c. Size Classification

The Lower Lisbon Dam has a maximum height of 24 feet and an estimated maximum storage capacity of 448 acre-feet. In accordance with USCE Guidelines, dams with maximum storage between 50 and 1000 acre-feet and heights less than 40 feet are sized as small. Therefore the size classification of the Lower Lisbon Dam is small.

d. Hazard Classification

A failure of the Lower Lisbon Dam would route the resulting flood wave into the existing channel of the Ammonoosuc River. Under all flow conditions, the lower channel has adequate reserve storage and bank height to dissipate any flood wave produced without overbank flow or structural damage.

e. Ownership

The current owner of the Lower Lisbon Dam is:

Public Service Company of New Hampshire
1000 Elm Street
Manchester, New Hampshire 03105

The former owner of the dam was:

Lisbon Light and Power Company
Lisbon, New Hampshire 03583

f. Operator

Although the dam is not being operated at the present time, the responsibility for the dam lies with the Owner:

Public Service Company of New Hampshire
1000 Elm Street
Manchester, New Hampshire 03105

Telephone: 603-669-4000

Contact: Mr. Lincoln Barre, District Superintendent

g. Purpose

The original purpose of the dam was power generation for the Lisbon Light and Power Company. The power generation equipment has been removed and the dam is serving no active purpose at the present time. In 1968 a study of the dam was made by the Corps of Engineers (CRREL) and the USDA Soil Conservation Service relative to the ice jamming upstream and whether the removal of the dam would relieve the jamming problem. The study concluded that the dam should not be removed because that might transfer the ice jamming problem to the rapid area just downsteam of the dam, causing flooding in the downtown area of Lisbon. Therefore the dam is serving a useful "passive" purpose in controlling ice jamming.

h. Design and Construction History

The existing concrete dam built in 1927 was a replacement for an earlier log crib dam. The concrete dam included a cut stone headwall and gates controlling flow into a headrace canal upstream of the power house. The cut stone headwall and the remains of the head gate can be seen in Photo 4. When the power house was deactivated the canal was filled in with impervious clay material. There have been no other construction changes at the site.

i. Normal Operational Procedure(s)

The dam is not being operated at the present time.

1.3 Pertinent Data

a. Drainage Area

The drainage basin above the Lower Lisbon Dam consists of 288 square miles of variable terrain. Elevations run from 800 to 1000 in the valley areas to 5000 to 6000 along the mountain ridges of the White Mountain National Forest. The drainage basin area is sparsely settled farm land with concentrated development in Lisbon, Littleton, Franconia and Bethlehem.

b. Discharge at Dam Site

The discharge at the dam site is controlled by a concrete overflow spillway 228 feet long. A waste gate located adjacent to the left abutment is not operated on a regular basis. The spillway capacity with the water level at the top of the dam is 28,500 CFS. This capacity is 85.1 percent of the 100-year test flood.

The maximum known flood on the pertinent section of the Ammonoosuc River occurred on March 18, 1936, recorded at the Bath gauge as 27,900 CFS. Transferring this flow to the dam using the six tenths ratio of their drainage areas gives a flood of 23,080 CFS at Lower Lisbon Dam. This flow would result in a flow depth of 8.3 feet over the spillway. Although this flood stage would not overtop the dam abutments it would cause considerable flooding along the left bank which is considerably lower than the dam abutment (see Photo 2).

c. Elevation	Feet (USGS)
Streambed at centerline of dam	550.3
Maximum tailwater	Not known
Upstream portal invert diversion tunnel	Not applicable
Recreation Pool	566.5
Full flood control pool	Not applicable
Spillway Crest	566.3
Design Discharge	Not known
Top of Dam	575.7
Test flood design surcharge	576.8

d. Reservoir	Feet
Length of maximum pool	8000
Length of recreation pool	6000
Length of flood control pool	Not applicable

e. Storage — Acre-Feet

Recreation pool	96
Flood control pool	Not applicable
Test flood pool	448
Spillway crest pool	96
Top of Dam	448

f. Reservoir Surface — Acres

Top dam	64
Test Flood Pool	64
Flood Control Pool	Not applicable
Recreation Pool	24
Spillway Crest	24

g. Dam

Type - concrete, gravity, run-of-river.

Length - 300 feet (overall)

Height - 24 feet (Maximum)

Top width - 3'±

Side slopes - vertical upstream, ogee weir downstream.

Zoning - Not known

Impervious core - solid concrete dam

Cutoff - None known.

Grout Curtain - None known, rock foundation

Drains - brick drain along foundation.

h. Diversion and Regulating Tunnel

Not applicable.

i. Spillway

Type - modified ogee weir.

Length of weir - 228 feet (two sections 222' + 6')

Crest elevation - 566.3.

Gates - None.

Upstream channel - Ammonoosuc River. Variable width 200 - 400 feet.

Downstream channel - Ammonoosuc River. Ledge rock bed, 150-200 feet wide.

j. Regulating Outlets

The only regulating outlet at the dam is a waste gate located adjacent to the old head gate wall and canal. The gate is 5 feet wide and 11'-4" deep with an invert elevation of approximately 555. During normal conditions the water level is approximately 3 inches below the top of the gate and any increase in water elevation above the 3-inch freeboard causes the gate to function as a spillway.

SECTION 2 - ENGINEERING DATA

2.1 Design

A detailed drawing showing the general plan of the dam and several section details was supplied by the present owner, the Public Service Company of New Hampshire.

The dam is a run-of-the-river gravity type concrete dam set on an irregular ledge rock foundation. The dam spans the river at oblique angles between several large outcroppings of ledge rock (see Plan in Appendix B). Resistance to sliding and overturning is provided by 1/2-inch reinforcing bars set into the ledge rock at 6-foot centers in addition to the normal gravity forces. The drawing also indicates that the dam is supplied with an interior drain along the ledge rock to relieve any hydrostatic pressure from building up under the concrete dam.

2.2 Construction

The construction of the dam began in August 1926 and was completed in October. The total volume of concrete used was 771 cubic yards.

The file data includes several pages of correspondence during the construction of the dam but there are no entries which are relevant to the present safety of the dam.

2.3 Operation

The dam is not being operated at the present time.

2.4 Evaluation

a. Availability

Construction drawings for this dam were available through the owner.

b. Adequacy

The construction drawings plus the visual observations are adequate for a Phase I evaluation of the dam and make recommendations as included in Section 7.

c. Validity

None of the observations made indicate conditions different from the engineering data except in the modifications at the left abutment where the intake channel was backfilled.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General

The dam is judged to be in good overall condition. At the time of inspection water was flowing over the overflow section of the dam.

b. Dam

The run-of-the-river dam is composed of three separate sections connected by rock outcroppings. The main overflow section is 228 feet long containing two angle points and extends from the right river bank to a large outcrop which also forms the footing of one of the highway bridge piers (see Photos 1 and 2). This section of the dam shows some spalling and erosion of the crest and downstream face but otherwise appears to be in good condition. Because of the water flowing over the dam, the outlet of the interior drain could not be observed.

The next section of the dam connects the outcrop mentioned above to another outcrop adjacent to the waste gate. This is a raised berm section approximately 34 feet long with a 6-foot stop log spillway located 7 feet from the left outcrop (see Photo 3). This section is in good condition with some spalled areas.

Adjacent to the left abutment the third section contains the waste gate described in the next section.

c. Appurtenant Structures

The 5-foot by 11-foot waste gate is located adjacent to the former head gate and head race canal to the old power house. The gate contains a mechanical rack and pinion lifting mechanism which was reported to be in good working order. There is some significant spalling and erosion of the concrete training walls and the gate is leaking at the bottom (see Photos 5 and 6).

A cut stone wall, located adjacent to the waste gate, was the entrance to the former head race canal of the old power house. The canal has been filled in with impervious material and there were no signs of leakage. The remains of the old canal head gates can be seen on the face of this wall (see Photo 4).

d. Reservoir Area

The upstream reservoir is located in a relatively wide river valley of the Ammonoosuc River. The adjacent land is good farm land which experiences flooding during spring runoff due to high river flows and ice jamming. The ice jamming has been a problem in the past and has been studied by the New Hampshire Water Resources Board and the Army Corps of Engineers (CRREL).

e. Downstream Channel

The downstream river channel is the lower channel of the Ammonoosuc River. The channel cuts through ledge rock outcrop for approximately 500 feet downstream of the dam. Below this section, the channel has been widened and riprapped on the right side bank to accommodate a recreational area.

3.2 Evaluation

The dam is judged to be in good overall condition based on the visual observation. Some significant spalling was noted on the berm section of the dam and at the waste gate training walls. The condition of the concrete spillway could not be fully evaluated because of the water flowing over the dam.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

There are no operating procedures at the present time.

4.2 Maintenance of Dam

There are no established maintenance procedures at the dam.

4.3 Maintenance of Operating Facilities

The only operating facility at the dam is the waste gate. Although there is no established maintenance procedure, the gate is reported to be in good operating condition.

4.4 Description of any Warning System in Effect

None exists for this dam.

4.5 Evaluation

The lack of any established maintenance or operational procedures is not having any significant effect on the safety of the dam.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General

The Lower Lisbon Dam is a gravity, concrete, run-of-the-river type dam.

b. Design Data

Record data from USGS Gauge 01138000, in Bath, New Hampshire was used for the hydrologic calculations for this dam.

c. Experience Data

Maximum floods which have occurred on the Ammonoosuc River, for which some recorded data exists (high water measurements) were in March 1936 and June 1973. The 1936 flood resulted in a flood stage of 6.8 feet and an estimated discharge of 15,770 CFS and the 1973 flood was 8.7 feet for an estimated discharge of 22,820 CFS. Neither flood resulted in overtopping of the abutment, but considerable flooding occurred in the commercial area along the left upstream embankment which is two to three feet below the top of the dam abutments.

d. Visual Observations

The dam was constructed at oblique angles across the river channel. The concrete sections are tied into the rock outcropping which adds considerable strength to the structure.

e. Test Flood Analysis

Based on the size and hazard category the 100-year test flood was selected for the hydraulic analysis of this dam. Record flow data was analyzed for gauge 01138000 located near Bath, New Hampshire, approximately 5 miles downstream of Lisbon. The results of the Bath analysis were then adjusted to suit Lower Lisbon by the ratio of their respective drainage areas to the six-tenths power. Because of the small storage capacity, the test flood inflow was assumed equal to the test flood outflow.

The flow data was processed by computer in accordance with the "United States Water Resources Council Guidelines - Bulletin 17." The computations resulted in a test flood of 33,500 CFS at the Lower Lisbon Dam. The computer input and data sheets can be found in Appendix D.

The spillway capacity of 28,500 CFS is approximately 85.1 percent of the 100-year test flood. This would result in the dam being overtopped at the low point of the left bank by approximately one foot. A commercial area of Lisbon along the left upstream abutment is considerably lower than the low point of the dam. The test flood would result in considerably deeper flooding in this area approaching 3-4 feet.

f. Dam Failure Analysis

The failure of the Lower Lisbon Dam would under normal conditions release a flood wave 11 feet high flowing at a rate of 2100 CFS. This wave would be readily contained within the first 1300 feet of channel downstream of the dam.

For the water to be at the top of the dam, elevation 575.7, the Ammonoosuc River would have to be flowing at a rate of 28,500 CFS which is about a 50-year flood. With a 36-foot wide breach forming in the dam the rate would suddenly increase to 33,500 CFS or about a 100-year flood. However, only 90 acre-feet would be lost from the reservoir pool during this flood event and thus would represent an insignificant increase in flood levels downstream.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The visual observations did not disclose any indication of structural instability. However, the extent of the visual inspection was limited by the flow of water over the dam and several important structural components could not be observed.

b. Design and Construction Data

The design drawing shows several sections of the solid concrete dam with its base on a very irregular bedrock surface. The dam is keyed into the bedrock outcroppings at several strategic locations and it is assumed the angular geometry of the dam is designed to transmit any sliding forces into the ledge rock. The drawings show half-inch diameter dowels 6 feet on center drilled into the bedrock. These dowels are too small and too widely spaced to offer any significant structural strength to the dam, and their design purpose is not known.

The drawings also show a brick drain along the bedrock surface with an outlet at the lowest point of the downstream toe of the dam. The outlet could not be observed and its operational condition is not known.

c. Operating Records

There are no operating records of significance with respect to the stability of the dam.

d. Post-Construction Changes

The only significant physical post-construction change was the filling-in of the headrace canal to the power house. The reservoir has undergone extensive siltation since its original construction. The siltation can be a negative structural factor by increasing slightly the horizontal force on the dam and a possible positive factor in reducing uplift pressures if the silt is impervious.

e. Seismic Stability

The dam is located in Seismic Zone 2 and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/ REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

The Lower Lisbon Dam was observed to be in good overall condition.

b. Adequacy

The information obtained during the investigation was adequate for a Phase I Inspection.

c. Urgency

The recommendations given in Section 7.2 should be carried out within the time period indicated under each item.

d. Need for Additional Investigation

The additional investigations described in Section 7.2 should be carried out.

7.2 Recommendations

A qualified professional engineer should investigate the following:

1. Within one year inspect the condition of the concrete when no water is flowing over the dam and inspect the drain outlet and estimate flow quantity and turbidity when no water is flowing over the dam.

2. Within two years repair spalled concrete on the waste gate training walls.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

Institute a program of biennial periodic technical inspection.

7.4 Alternatives

Not applicable.

APPENDIX A

VISUAL INSPECTION CHECK LIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT LOWER LISBON DAM

DATE November 15, 1978

TIME 8:00 AM - 10:15 AM

WEATHER Cloudy, cool

W.S. ELEV. _____ U.S. ___ DN.S.

PARTY:

1. Sherward G. Farnsworth D-H
2. James H. Maynes D-H
3. James A. Dohrman D-H
4. Gonzalo Castro GEI
5. Ken Stern, New Hampshire Water Resources Board
6. _____
7. _____
8. _____
9. _____
10. _____

PROJECT FEATURE	INSPECTED BY	REMARKS
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9.		
10.		

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER LISBON DAM DATE November 15, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
DAM OVERFLOW SECTION	Concrete gravity on ledge - dam flowing.
Crest Elevation	566.3
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	Spalling observed on crest and downstream slope.
Pavement Condition	None.
Movement of Settlement of Crest	None.
Lateral Movement	None.
Vertical Alignment	Good.
Horizontal Alignment	Good.
Condition at Abutment and at Concrete Structures	Ledge.
Indications of Movement of Structural Items on Slopes	None.
Trespassing on Slopes	None.
Sloughing or Erosion of Slopes or Abutments	Not applicable.
Rock Slope Protection - Riprap Failures	Not applicable.
Unusual Movement or Cracking at or Near Toes	Not observable - under water
Unusual Embankment or Downstream Seepage	Not observable - under water.
Piping or Boils	Not applicable.
Foundation Drainage Features	None known.
Toe Drains	None.
Instrumentation System	None.
Vegetation	None.

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER LISBON DAM DATE November 15, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	NONE
a. Concrete and Structural	
General Condition	
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System in Gate Chamber	

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER LISBON DAM DATE November 15, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	NONE
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER LISBON DAM DATE November 15, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	Waste Gate
General Condition of Concrete	Fair.
Rust or Staining	Not applicable.
Spalling	At downstream training walls.
Erosion or Cavitation	Under gate, at left wingwall.
Visible Reinforcing	Yes, at gate wingwalls.
Any Seepage or Efflorescence	None observed.
Condition at Joints	Good (under water).
Drain Holes	None observed.
Channel	Ledge.
Loose Rock or Trees Overhanging Channel	None.
Condition of Discharge Channel	Natural stream - good (ledge).

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER LISBON DAM DATE November 15, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	River reservoir.
General Condition	Good.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	None.
Floor of Approach Channel	Sediment within 2-3 feet of surface.
b. Weir and Training Walls	
General Condition of Concrete	Good.
Rust or Staining	None.
Spalling	None.
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	
c. Discharge Channel	Rough ledge - river bed.
General Condition	Good.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	None.
Floor of Channel	Ledge.
Other Obstructions	Two bridge piers (minimum).

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER LISBON DAM DATE November 15, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	NONE.
a. Approach Channel	
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER LISBON DAM DATE November 15, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	NONE
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutments and Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat and Backwall	

PERIODIC INSPECTION CHECK LIST

PROJECT LOWER LISBON DAM DATE November 15, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
RESERVOIR	
Stability of Shoreline	Right bank - loose stone retaining wall, with concrete cap, some missing stones.
Sedimentation	
Changes in Watershed Runoff Potential	None known.
Upstream Hazards	Ice jamming reported in winter.
Downstream Hazards	None.
Alert Facilities	None.
Hydrometeorological Gages	None.
Operational and Maintenance Regulations	None.

APPENDIX B

PROJECT RECORDS AND PLANS

1. Listing of Design, Construction and Maintenance Records:

   a. Specifications and Construction Report

2. Copies of Past Inspection Reports:

   a. New Hampshire Water Resources Board - July 23, 1936
   b. New Hampshire Water Resources Board Data Sheet, 1939
   c. U. S. Army Terrestrial Sciences Center Statement on Ice Jamming - December 3, 1968

3. Plans:

   a. Drawings 954-1 provided by Owner

Specifications for Dam, Wastegate & Abutments

Lisbon Light & Power Co.

Lisbon, N.H.

June 15, 1926

The work covered by these specifications includes:

1. The construction of a solid concrete dam in the Ammonoosuc River in the town of Lisbon, N. H. This dam is to be just downstream from the existing timber crib dam known as the Upper Lisbon Dam.

2. The construction of low abutments or wing dams at each end of the dam.

3. The construction of a reinforced concrete wastegate structure between the canal and the river, near the present canal headgates.

4. The setting of all iron work, dowels, gate frames, anchor bolts, etc. required above.

5. All other work, including the building, maintenance, and removal of all coffer dams, the pumping and excavation, etc., that may be a part of the above.

6. The removal of such parts of the present timber dam and its planking that may be ordered by the engineer.

7. Any extra work appurtenant to the dam or wastegate which may be ordered by the engineer from time to time.

All work is to be done in accordance with the

Lisbon, N. H.

Lisbon Light and Power Co.

I-1789 Construction of dam on the Ammonoosuc River at Lisbon, N. H.

Gravity type, concrete dam, ledge foundation, built downstream adjacent to old log dam.

A sluiceway and waste gate were built near head gates (through ledge).

The contractors begun work in August and finished in October 1926. First concrete in dam was poured August 6, and last September 10, 1926.

Total elapsed time 36 days. Total days concrete poured was 25.

References: Plans, D-1386; Correspondence, etc., I-1789; Computations, progress views, tests and memoranda, see I-1789, Lisbon Light & Power Company File H.

Samuel J. Lisle

May 25, 1927.

SJL:GMG

DATA ON DAMS IN NEW HAMPSHIRE

LOCATION — STATE NO. 138.01

Town: Lisbon ✓ : County: Grafton

Stream: Ammonoosuc River

Basin-Primary: Conn R. ✓ : Secondary: Ammonoosuc R. ✓

Local Name:

Coordinates—Lat. 44° 10' + 17500 : Long. 71° 55' - 1900

GENERAL DATA

Drainage area: Controlled ..... Sq. Mi.: Uncontrolled ..... Sq. Mi.: Total 203 ✓ Sq. Mi.

Overall length of dam 300 ft.: Date of Construction

Height: Stream bed to highest elev. 24 ✓ ft.: Max. Structure 131 5" ft.

Cost—Dam : Reservoir

DESCRIPTION Concrete split stone on Ledge— Gravity ✓

Waste Gates

Type

Number 3 : Size ft. high x ft. wid

Elevation Invert : Total Area sq. ft.

Hoist

Waste Gates Conduit

Number : Materials

Size ft.: Length ft.: Area sq. ft.

Embankment

Type

Height—Max. ft.: Min. ft.

Top—Width : Elev. ft.

Slopes—Upstream on: Downstream on

Length—Right of Spillway : Left of Spillway

Spillway

Materials of Construction Concrete

Length—Total ft.: Net 254 ✓ ft.

Height of permanent section—Max. 1[illegible] ft.: Min. ft.

Flashboards—Type none : Height ft.

Elevation—Permanent Crest : Top of Flashboard

Flood Capacity 8000 cfs.: 27.8 cfs/sq. mi.

Abutments

Materials:

Freeboard: Max. 41 7" ✓ ft.: Min. ft.

Headworks to Power Devel.—(See "Data on Power Development")

OWNER Public Service ✓

REMARKS Use--- Power--- Public Utility
Dam is a Menace

Tabulation By A N & R L T Date Jan 25, 1939

B&M-1-34

PUBLIC SERVICE COMMISSION OF NEW HAMPSHIRE—DAM RECORD

TOWN: Lisbon	TOWN NO. 1	STATE NO. 12
RIVER STREAM: Ammonoosuc River		
DRAINAGE AREA:	POND AREA:	
DAM TYPE: Gravity	FOUNDATION NATURE OF: Ledge	
MATERIALS OF CONSTRUCTION: Concrete, Split Stone		
PURPOSE OF DAM: POWER—CONSERVATION—DOMESTIC—RECREATION—TRANSPORTATION—PUBLIC UTILITY		
HEIGHTS, TOP OF DAM TO BED OF STREAM: Approx. 24'	TOP OF DAM TO SPILLWAY CRESTS: 21-7"	
SPILLWAYS, LENGTHS DEPTHS BELOW TOP OF DAM: Approx. 224'		LENGTH OF DAM: 300'
FLASHBOARDS TYPE, HEIGHT ABOVE CREST: None		
OPERATING HEAD CREST TO N. T. W.: 14'	TOP OF FLASHBOARDS TO N. T. W.	
WHEELS, NUMBER KINDS & H. P.: 1-Leffel - 48" 225 HP 1-Holyoke 48" 225 HP		
GENERATORS, NUMBER KINDS & K. W.: 1-G.E. AC 150 KW 2300V - 47 A - 60 cycle 3ϕ		
H. P. 90 P. C. TIME 100 P. C. EFF.	H. P. 75 P. C. TIME 100 P. C. EFF.	
REFERENCES, CASES, PLANS, INSPECTIONS		

REMARKS

OWNER: Public Service Co. of N. H.

CONDITION: Good

MENACE: Yes. Will be subject to periodic inspection.

To the Public Service Commission:

The foregoing memorandum on the above dam is submitted covering inspection made July 23, 1936, according to notification to owner dated July 15, 1936, and bi for same is enclosed.

D. Waldo White
Chief Engineer

August 6, 1936
Copy to Owner

DEPARTMENT OF THE ARMY
U.S. ARMY TERRESTRIAL SCIENCES CENTER
HANOVER, NEW HAMPSHIRE 03755

AMXTS-EA

3 December 1968

Mr. Vern Knowlton
Water Resources Board
State of New Hampshire
State Office Building
Concord, New Hampshire 03301

Dear Mr. Knowlton:

During the meeting at USA TSC on 10 October 1968 regarding ice jam problems on rivers in New Hampshire, you requested us to visit Lisbon, New Hampshire and observe the Ammonoosuc River for potential ice jams. The primary purpose of the observation was to give an opinion on whether the dam, located upriver from the town bridge, should be removed.

On 14 October 1968 Messrs. Nevel, Huckabee, and Frankenstein of this office visited the above-mentioned site. Observations were made of the river a distance of approximately one mile upriver and downriver of the dam site. It is our opinion that the dam should not be removed. There is a long rapid area 500 feet downriver from the bridge. If the dam is removed this rapid area will cause the moving ice to jam which could cause flooding in the town area.

We would appreciate being informed of any ice jam problems in the future.

If we can be of further assistance, please let us know.

Sincerely yours,

Donald E. Nevel

for

GUENTHER E. FRANKENSTEIN
Research Civil Engineer
Applied Research Branch

NEW HAMPSHIRE WATER CONTROL COMMISSION

DATA ON WATER POWER DEVELOPMENTS IN NEW HAMPSHIRE

LOCATION AT DAM NO. 138.01

Town Lisbon : County Grafton

Stream Ammonoosuc R.

Basin-Primary Conn R. : Secondary Ammonoosuc

Local Name

GENERAL DATA

Head-~~Max.~~ 13.3 ft.: ~~Min.~~ 14 ft.: Ave. ft.

Date of Construction : Use of Power Public Utility—Power

Pondage ac. ft.: Storage ac. ft.

DESCRIPTION

Racks

Size of Rack Opening

Size of Bar : Material

Area: Gross Sq. Ft.: Net sq. ft.

Head Gates

Type

Number : Size ft. high x ft. wide

Elevation of Invert : Total Area sq. ft.

Hoist

Penstock

Number : Material

Size : Length

Turbines

Number 2 : Makers 46" Leffell 46" Holyoke

Rating HP. per unit : Total Capacity HP.

Max. Dement C.F.S., per unit : Total cfs.

Drive

Type

Generator

Number 1

Make G E A C 150 K W 2300 V— 47A— 60 Cycle 3

Rating KW., per unit ; Total Capacity 150 K.W.

Exciter

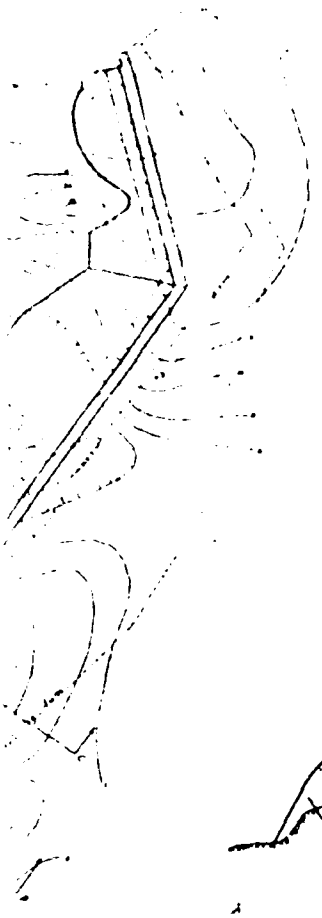
Number : Make

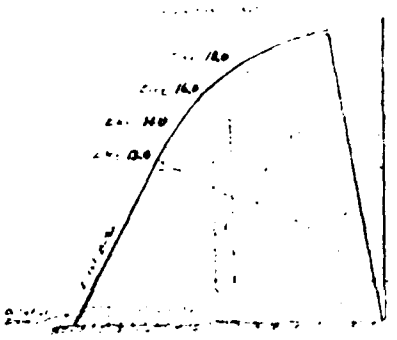
Rating-per unit : Total Capacity K. W.

OUTPUT—KWHRS

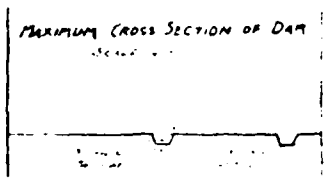
19.....	:	19.....	
19.....	:	19.....	
19.....	:	19.....	
19.....	:	19.....	
19.....	:	19.....	

OWNER Public Service Co Manchester N.H

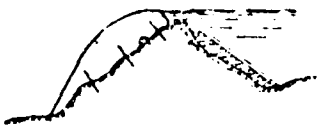




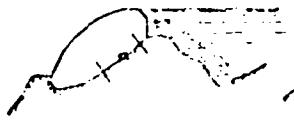
MAXIMUM CROSS SECTION OF DAM



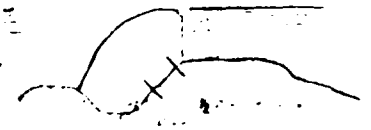
DETAIL OF KEYS IN BULKHEAD



A-A



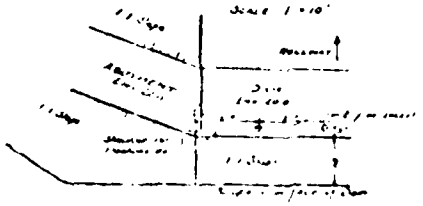
B-B



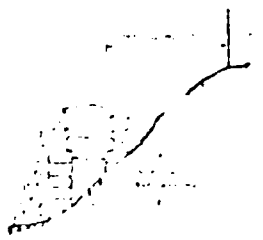
C

CROSS SECTIONS OF DAM
SCALE 1"=10'

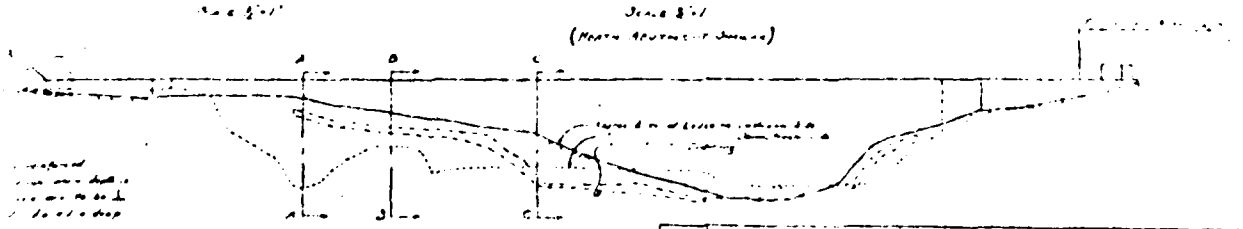
SECTION THROUGH SOUTH ABUTMENT AT D-D



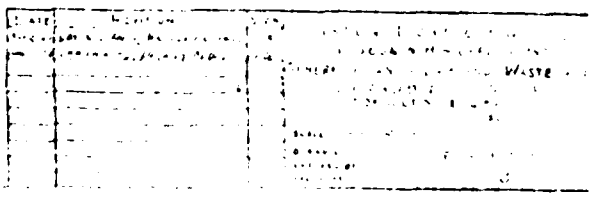
DETAIL PLAN OF DAM AND SOUTH ABUTMENT
SCALE 1"=1'
(NORTH ABUTMENT SIMILAR)

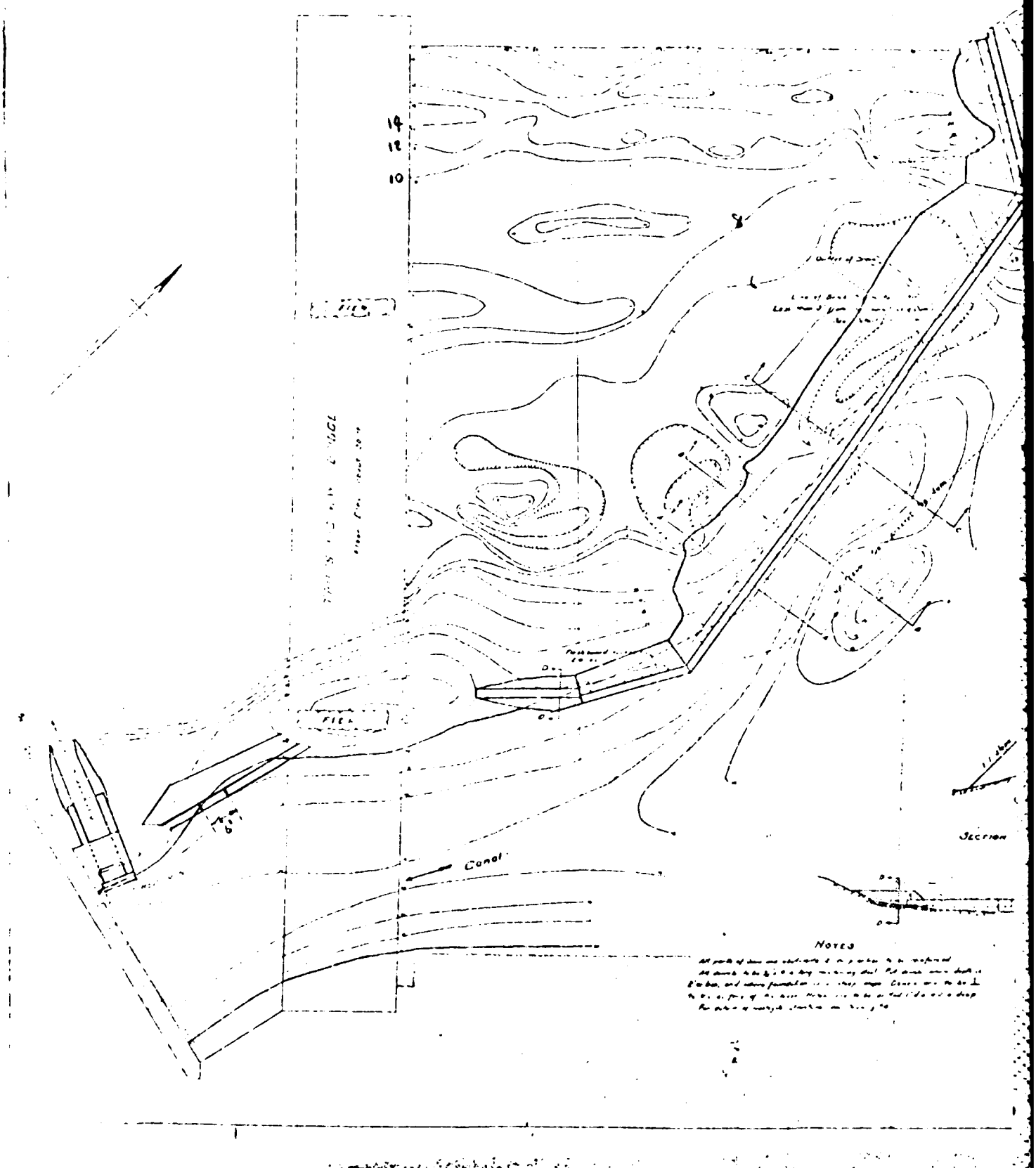


TYPICAL DETAIL OF PRICE DRAIN



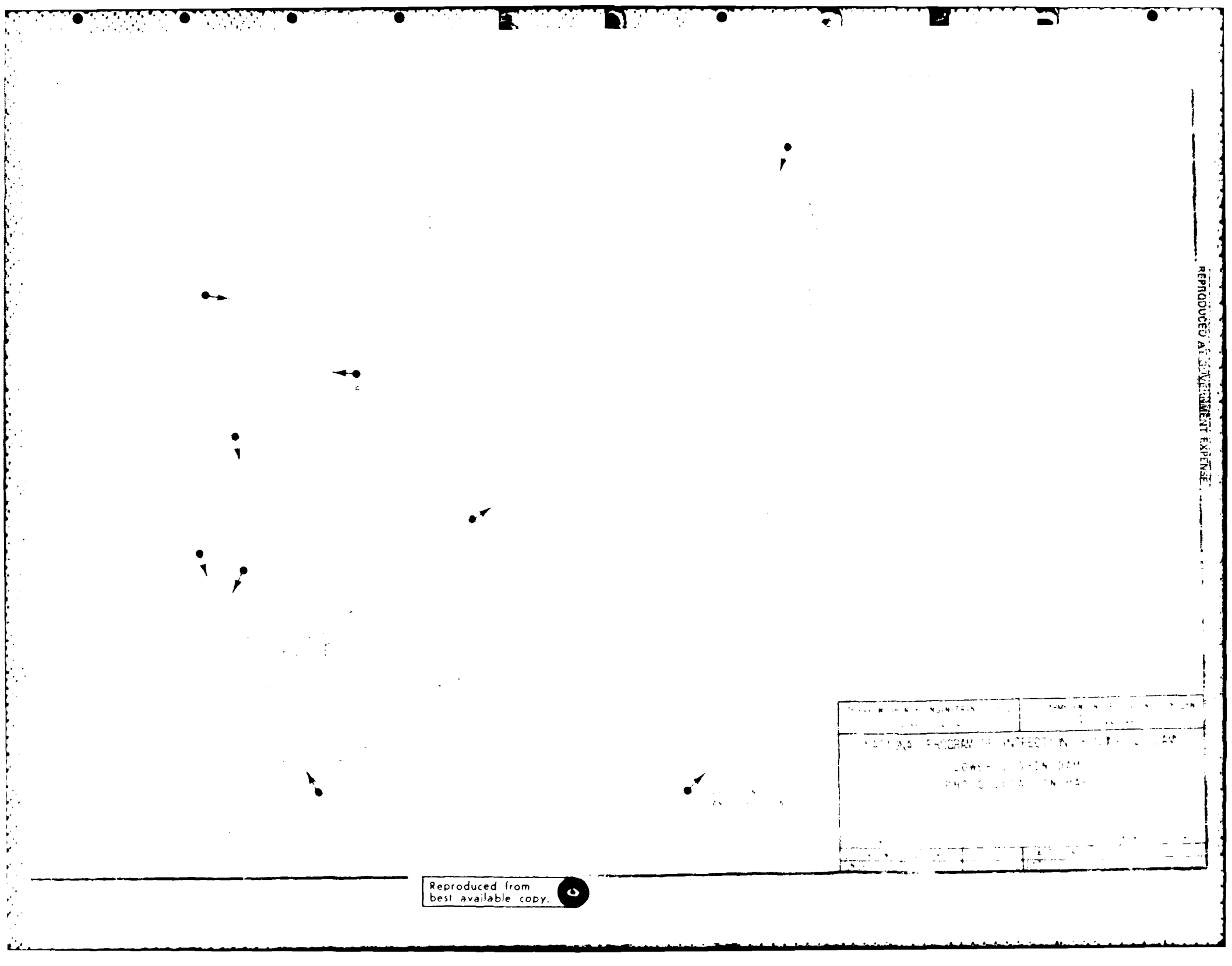
ELEVATION OF DAM
LOOKING DOWN STREAM





APPENDIX C

PHOTOGRAPHS



#1. VIEW OF SPILLWAY

#2. VIEW OF SPILLWAY

#3. VIEW OF WASTE GATE AND FORMER HEADRACE CANAL

#4. VIEW OF WASTE GATE

#5. VIEW OF SPALLING ON WASTE GATE TRAINING WALLS

#6. VIEW OF WASTE GATE SHOWING LEAK

#7. VIEW OF DAM AND BRIDGE FROM DOWNSTREAM

#8. VIEW OF DOWNSTREAM CHANNEL

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

DUFRESNE-HENRY ENGINEERING CORPORATION

SUBJECT LOWER LISBON DAM — SHEET NO. ___ OF ___
SCALE AND STORAGE ESTIMATES — JOB NO. ___

LENGTH

NORMAL POOL = 6000 LF

MAX POOL = 8000 LF

WIDTH

NORMAL POOL = 175'

MAX POOL = 350'

DEPTH

NORMAL POOL = 4 FEET

MAX POOL = 7 FEET

SURFACE

NORMAL = 6000 × 175 = 1,050,000 = 24 ACRES

MAX. = 8000 × 350 = 2,800,000 64 ACRES

STORAGE

NORMAL = 24 × 4 = 96 AC.-FT

MAX. = 64 × 7 448 AC-FT

DUFRESNE-HENRY ENGINEERING CORPORATION

BY W.H. Leonard SUBJECT Lisbon Dam SHEET NO. 1 OF 6

DATE [illegible] Drainage Area / Classification JOB NO. [illegible]

Drainage Area

Drainage area above the Lisbon Dam is 283 sq mi. Taken from N.H. Water Resources Board.

Dam Classification

Size

Height 24'

Small

Hazard

Wide river channel downstream

Low

DRAINAGE AREA FOR GAGING STATION 01138000 ON THE AMMONOOSUC RIVER NEAR BATH IS 395 SQ. MI.

DRAINAGE AREA FOR LISBON DAM IS 288 SQ. MI.

$$Q_{AT\ DAM} = \left(\frac{DA_{AT\ DAM}}{DA_{AT\ BATH}}\right)^{.60} (100YR\ FLOOD\ @\ BATH)$$

.60 FACTOR BASED ON RECORDED FLOW FREQUENCY DATA AT THE GAGING STATION 01138000 ON THE AMMONOOSUC RIVER NEAR BATH AND GAGING STATION 01137500 ON THE AMMONOOSUC RIVER AT BETHLEHEM JUNCTION

$$Q_{AT\ DAM} = \left(\frac{288}{395}\right)^{.6} (40,472) = 33,484\ cfs$$

40,472 FLOW TAKEN FROM FLOOD FLOW FREQUENCY COMPUTER COMPUTATION FOR BATH GAGING STATION.

TEST FLOODS - FOR SMALL-LOW HAZARD DAM ⇒ 100YR FLOOD

100 YEAR FLOOD AT LISBON DAM = 33,484 cfs

CREST ELEV (U.S.G.S.) = 566.3
ASSUME C = 3.9 FOR WEIR

h = 0 Q = 0 WSEL = 566.3

h = 1 WSEL = 567.3 L = 228'

$Q = CLH^{3/2} = 3.9(228)(1)^{3/2} =$ 889 cfs

h = 2 WSEL = 568.3 L = 228

Q =	$3.9(228)(2)^{3/2}$ =	2515
+	$3.3(2)(1)^{3/2}$ =	7
	Q_{TOTAL} =	2522 cfs

h = 3 WSEL = 569.3

Q =	$3.9(228)(3)^{3/2}$ =	4620
+	$3.3(2)(3)^{3/2}$ =	19
+	$3.6(24)(1)^{3/2}$ =	94
	Q_{TOTAL} =	4733 cfs

h = 4 WSEL = 570.3

Q =	$3.9(228)(4)^{3/2}$ =	7114
+	$3.3(2)(3)^{3/2}$ =	31
+	$3.6(24)(2)^{3/2}$ =	265
	Q_{TOTAL} =	7413 cfs

h = 5 WSEL = 571.3

Q =	$3.9(228)(5)^{3/2}$ =	9042
+	$3.3(2)(4)^{3/2}$ =	53
+	$3.6(24)(3)^{3/2}$ =	486
+	$3.6(10)(1)^{3/2}$ =	25
	Q_{TOTAL} =	10,516 cfs

h = 6 WSEL = 572.3

Q =	$3.9(228)(6)^{3/2}$ =	13,069
+	$3.3(2)(5)^{3/2}$ =	74
	$3.6(24)(4)^{3/2}$ =	749
	[illegible] =	[illegible]
	[illegible] =	13,201 cfs

h = 17 WSEL = 572.3

Q = 3.9(22.8)(7)^3/2 = 16,468

+ 3.3(2)( ) = 97

+ 3.6(26)(5)^3/2 = 1,046

+ 3.5( )(2)^3/2 = 182

Q TOTAL = 17,793 cfs

h = 9 WSEL = 574.3

Q = 3.9( )( )^3/2 = 20,120

+ 3.3(2)(7)^3/2 = 122

+ 3.6(26)( )^3/2 = 1376

+ 3.5( )( )^3/2 = 280

Q TOTAL = 21,899 cfs

h = 9 WSEL = 575.3

Q = 3.9( )( )^3/2 = 24,008

+ 3.3(2)( )^3/2 = 149

+ 3.6(26)( )^3/2 = 1,734

+ 3.5( )( )^3/2 = 391

Q TOTAL = 26,282 cfs

h = 10 WSEL = 576.3

Q = 3.9(22.8)(10)^3/2 = 28,119

+ 3.3(2)(9)^3/2 = 178

+ 3.6(26)(8)^3/2 = 2,118

+ 3.5( )(6)^3/2 = 514

Q TOTAL = 30,929 cfs

h = 11 WSEL = 577.3

Q = 3.9( )( )^3/2 = 32,441

+ 3.3(2)( )^3/2 = 209

+ 3.6(26)( )^3/2 = 2,577

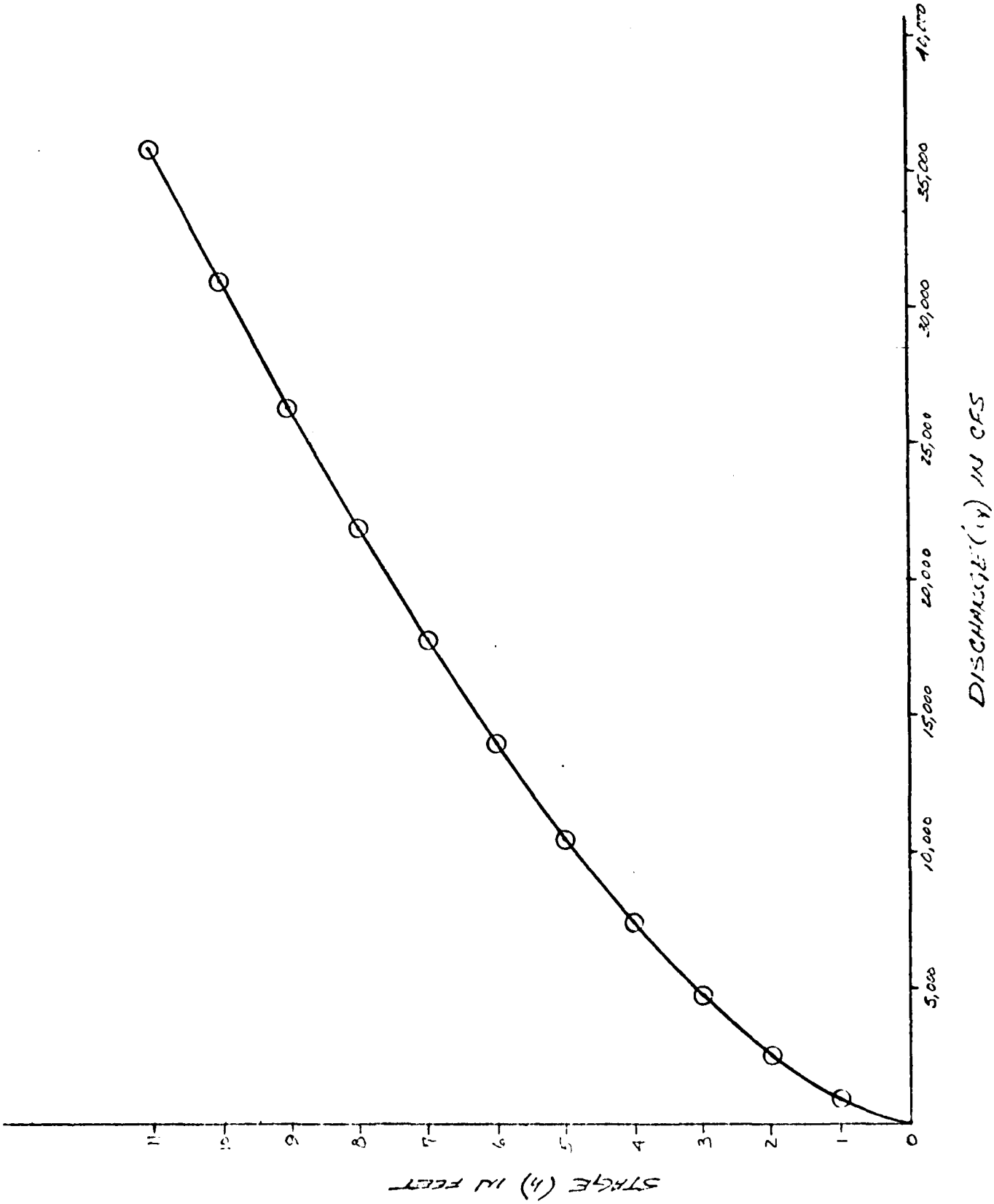
+ 3.5(10)( )^3/2 = 648

Q TOTAL = 35,875 cfs

DUFRESNE-HENRY ENGINEERING CORPORATION

BY W. H. LEONARD SUBJECT LISBON DAM SHEET NO. 5 OF 6

DATE 3-12-79 STAGE VS. DISCHARGE JOB NO. 04-006



DUFRESNE-HENRY ENGINEERING CORPORATION

BY W.A. LEONARD SUBJECT LISBON DAM SHEET NO. 6 OF 6
DATE 3-1-79 1973 FLOOD VS TEST FLOOD JOB NO. 04-0056

THE 1973 FLOOD RECORDED AT GAGING STATION 01138000 NEAR BATH WAS 26,900 cfs. THIS FLOW REPRESENTED APPROXIMATELY THE 25-YEAR FREQUENCY FLOOD.

TRANSPOSING THIS FLOOD TO LISBON AS ONE OF THE 100-YEAR FLOOD —

$$Q_{DAM} = \left(\frac{DA_{@\,DAM}}{DA_{@\,BATH}}\right)^{.60} (1973\ FLOOD\ FLOW)$$

$$Q_{25\text{-YEAR @ DAM}} = \left(\frac{296}{295}\right)^{.6} (26{,}900) = \underline{22{,}255\ cfs}$$

COMPARING THIS TO THE STAGE-DISCHARGE DATA, FOR THE 25-YEAR FLOOD @ LISBON DAM, $h = 8'$ +.

∴ WSEL ≈ 574.3 WHICH COMPARES QUITE CLOSELY TO OBSERVED HIGH WATER MARKS DURING THE 1973 FLOOD AT LISBON OF 575.0.

FOR THE 100-YEAR (TEST FLOOD) FLOWS, THE h VALUE WOULD BE APPROXIMATELY 10.5' WHICH IS 2½ FEET HIGHER THAN THOSE OBSERVED HIGH WATER MARKS IN 1973.

DUFRESNE-HENRY ENGINEERING CORPORATION

BY [illegible] SUBJECT [illegible] SHEET NO. ___ OF ___
DATE [illegible] JOB NO. [illegible]

DAM FAILURE ANALYSIS :

Normal [illegible]

Length across [illegible] at mid-height is about 1/3 of total length due to ledge.

566.5 − 550.3 = 16.2′

$\frac{2}{3} Y_0 = 10.8'$

$Q = (.4)(89.\frac{8}{27}\sqrt{[illegible]})(10.8)^{3/2} = [illegible]5$ CFS

V = [illegible] [illegible]-feet [illegible] feet/[illegible] [illegible] [illegible] 291 feet.

Top of Dam – Flood Stage

575.7 − 550.3 = 25.4′

$Q = .4(89)\frac{8}{27}\sqrt{[illegible]}(25.4)^{3/2} = 7,[illegible]$ CFS from breach

Q over dam at 575.7 = 23,5[illegible] CFS − 50-Year Flood

Q over unbreached 230′ section = $3.9(230)(9.4)^{3/2}$ = 25,[illegible]51 CFS

Total Q at failure = 33,507 [illegible]

Volume retained is determined by flow through breach at critical depth and over crest of remaining dam.

8′ over crest

$Q_{dam} = (3.9)(230)(8)^{3/2} = 20,300$ CFS

$Q_{breach} = (3.08)(36)(24.2)^{3/2} = 13,2[illegible]$ CFS

33,2[illegible] CFS

V = 1.4 × 64 = 89.6 Acre-feet

$\frac{2}{3} Y_0 = 16.7'$

FLOOD FLOW FREQUENCY COMPUTATION

01136000 AMMONOOSUC RIVER NEAR BATH, NEW HAMPSHIRE

N	NQH	NOUTL	IYRA	IPLOT	IEXPP	SKEW	A	B	PRELM
42	0	0	1936	1	1	0.500	0.0	0.0	0.0

FINAL RESULTS

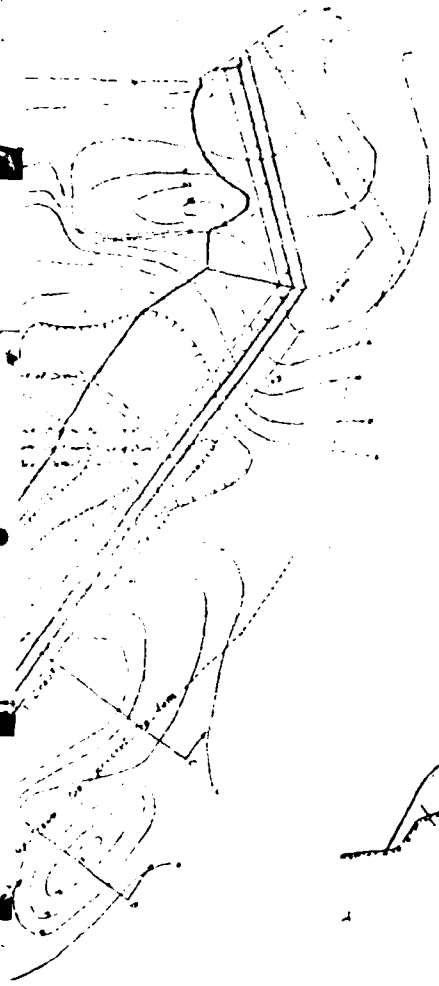
DAY	MONTH	YEAR	FLOW	ORDERED	RANK	PLOT POS
0	0	1936	27000.	27000.	1	0.0238
0	0	1937	12400.	20400.	2	0.0465
0	0	1938	20600.	20600.	3	0.0698
0	0	1939	14700.	20500.	4	0.0930
0	0	1940	12400.	19600.	5	0.1163
0	0	1941	6000.	18800.	6	0.1395
0	0	1942	7440.	17800.	7	0.1628
0	0	1943	6600.	17400.	8	0.1860
0	0	1944	12700.	16000.	9	0.2093
0	0	1945	7350.	14700.	10	0.2326
0	0	1946	8270.	14200.	11	0.2558
0	0	1947	17300.	13400.	12	0.2791
0	0	1948	6750.	14200.	13	0.3023
0	0	1949	6400.	13200.	14	0.3256
0	0	1950	13500.	13000.	15	0.3488
0	0	1951	17000.	12700.	16	0.3721
0	0	1952	14300.	12600.	17	0.3953
0	0	1953	21000.	11900.	18	0.4186
0	0	1954	16900.	11600.	19	0.4419
0	0	1955	6500.	11300.	20	0.4651
0	0	1956	4220.	10700.	21	0.4884
0	0	1957	7410.	10200.	22	0.5116
0	0	1958	11000.	10100.	23	0.5349
0	0	1959	7700.	9400.	24	0.5581

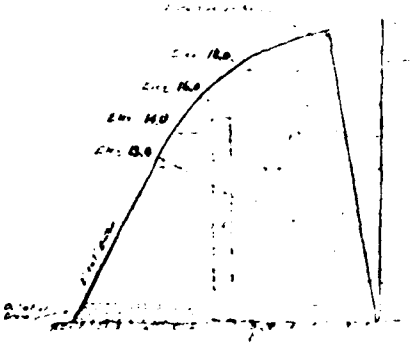
0	0	1960	23500.	9220.	25	0.5014
0	0	1961	4500.	9200.	26	0.6047
0	0	1962	8270.	9000.	27	0.6279
0	0	1963	10200.	8500.	28	0.6512
0	0	1964	8870.	8330.	29	0.6744
0	0	1965	5750.	8270.	30	0.6977
0	0	1966	7750.	8270.	31	0.7209
0	0	1967	6230.	8250.	32	0.7442
0	0	1968	11400.	8070.	33	0.7674
0	0	1969	13200.	7770.	34	0.7907
0	0	1970	11000.	7350.	35	0.8140
0	0	1971	5220.	6670.	36	0.8372
0	0	1972	10100.	6600.	37	0.8605
0	0	1973	25500.	6000.	38	0.8837
0	0	1974	20500.	5920.	39	0.9070
0	0	1975	10700.	5730.	40	0.9302
0	0	1976	11300.	5200.	41	0.9535
0	0	1977	9000.	4940.	42	0.9767

MEAN	4.0411
STD DEV	0.1465
COMPUTED SKEW	0.3702
REGIONAL SKEW	0.5000
ADOPTED SKEW	0.4706

FLOW IN CUBIC FEET PER SECOND

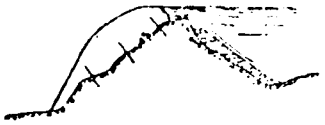
COMPUTED FLOW	EXPECTED-PROBABILITY FLOW	PROBABILITY	.05 LIMIT	.95 LIMIT
[illegible]	61000.	0.002	78048.	41120.
[illegible]	43736.	0.005	61234.	[illegible]
[illegible]	[illegible]	0.010	50404.	30103.
[illegible]	[illegible]	0.020	41217.	25973.
[illegible]	[illegible]	0.040 (?)	33209.	22157.
[illegible]	23337.	0.100	24270.	[illegible]
[illegible]	[illegible]	0.200	18559.	[illegible]
[illegible]	[illegible]	0.500	11926.	9406.
7417.	[illegible]	0.800 (?)	8415.	[illegible]
[illegible]	[illegible]	0.900 (?)	7212.	[illegible]
5517.	[illegible]	0.950 (?)	6422.	4521.
4433.	[illegible]	[illegible]	5289.	3492.



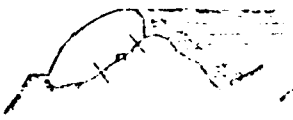


MAXIMUM CROSS SECTION OF DAM

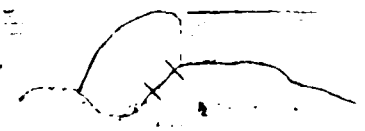
DETAIL OF KEYS IN BURROAD



A-A



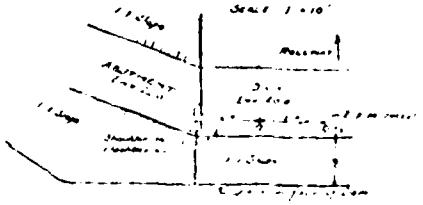
B-B

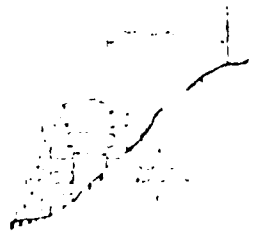


C

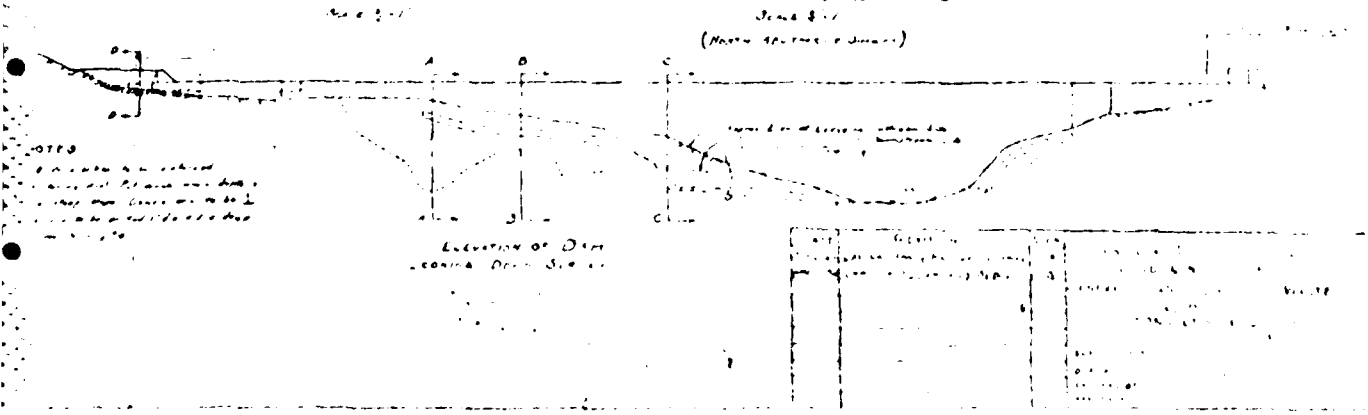
CROSS SECTIONS OF DAM

SECTION THRU N SOUTH ABUTMENT AT D.D



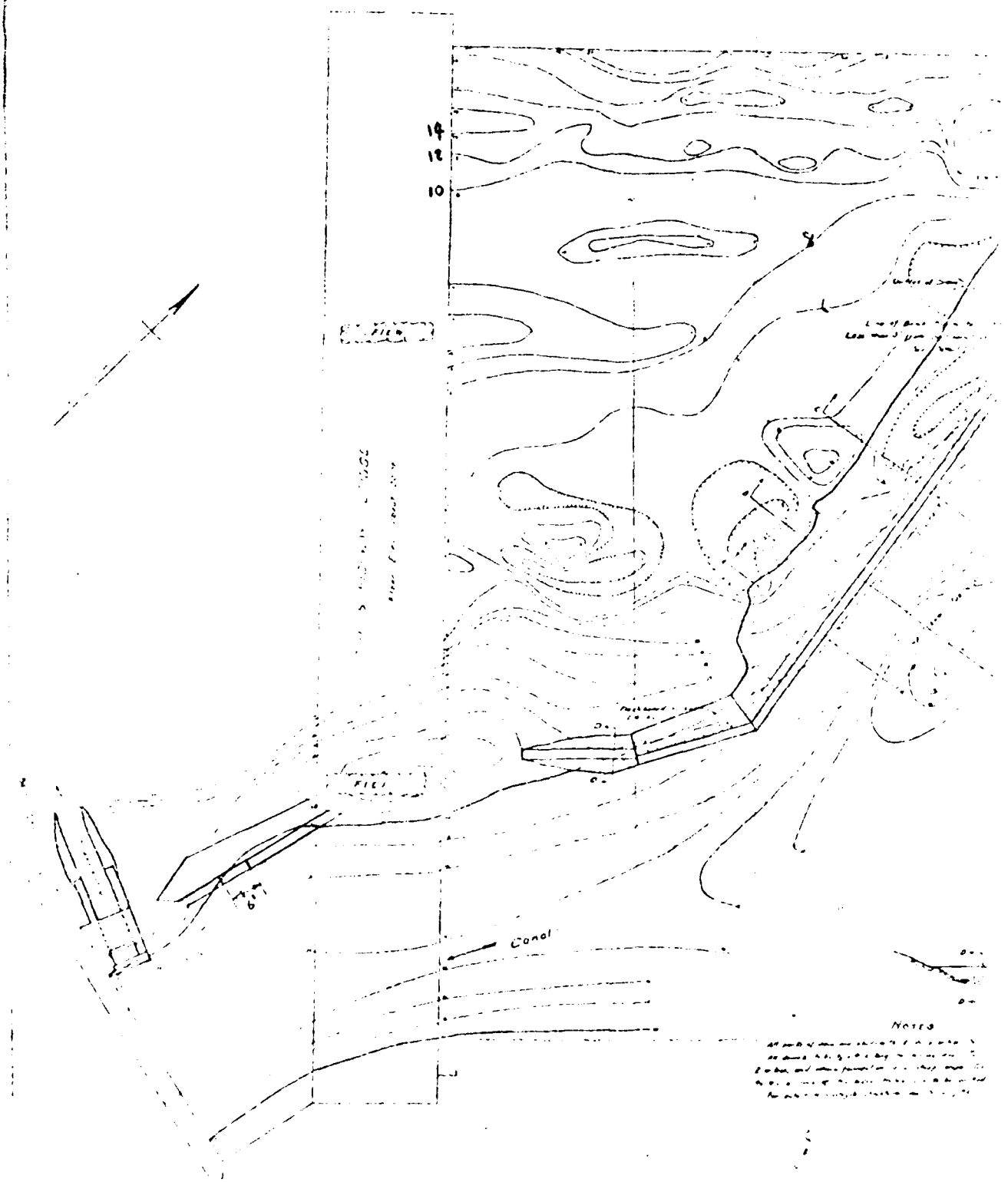


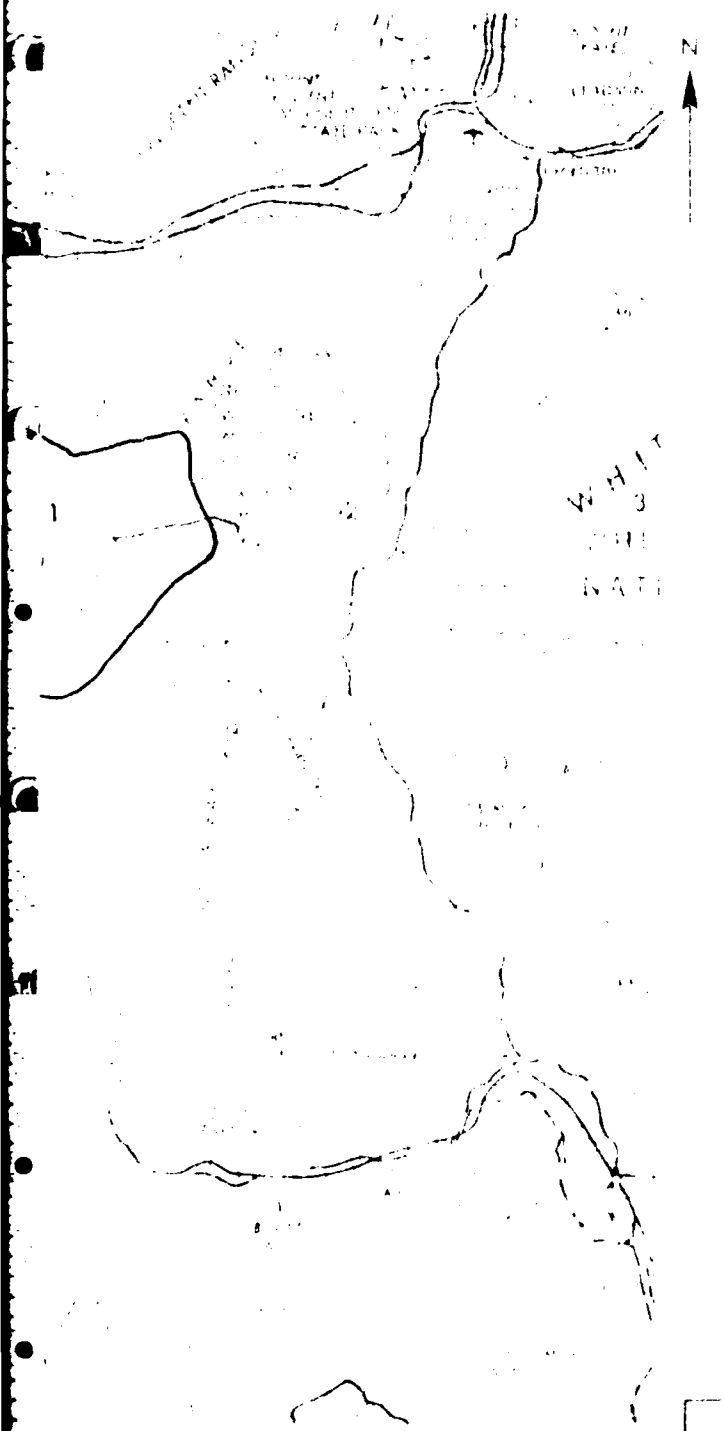
TYPICAL DETAIL OF VOICE DRAIN



NOTES

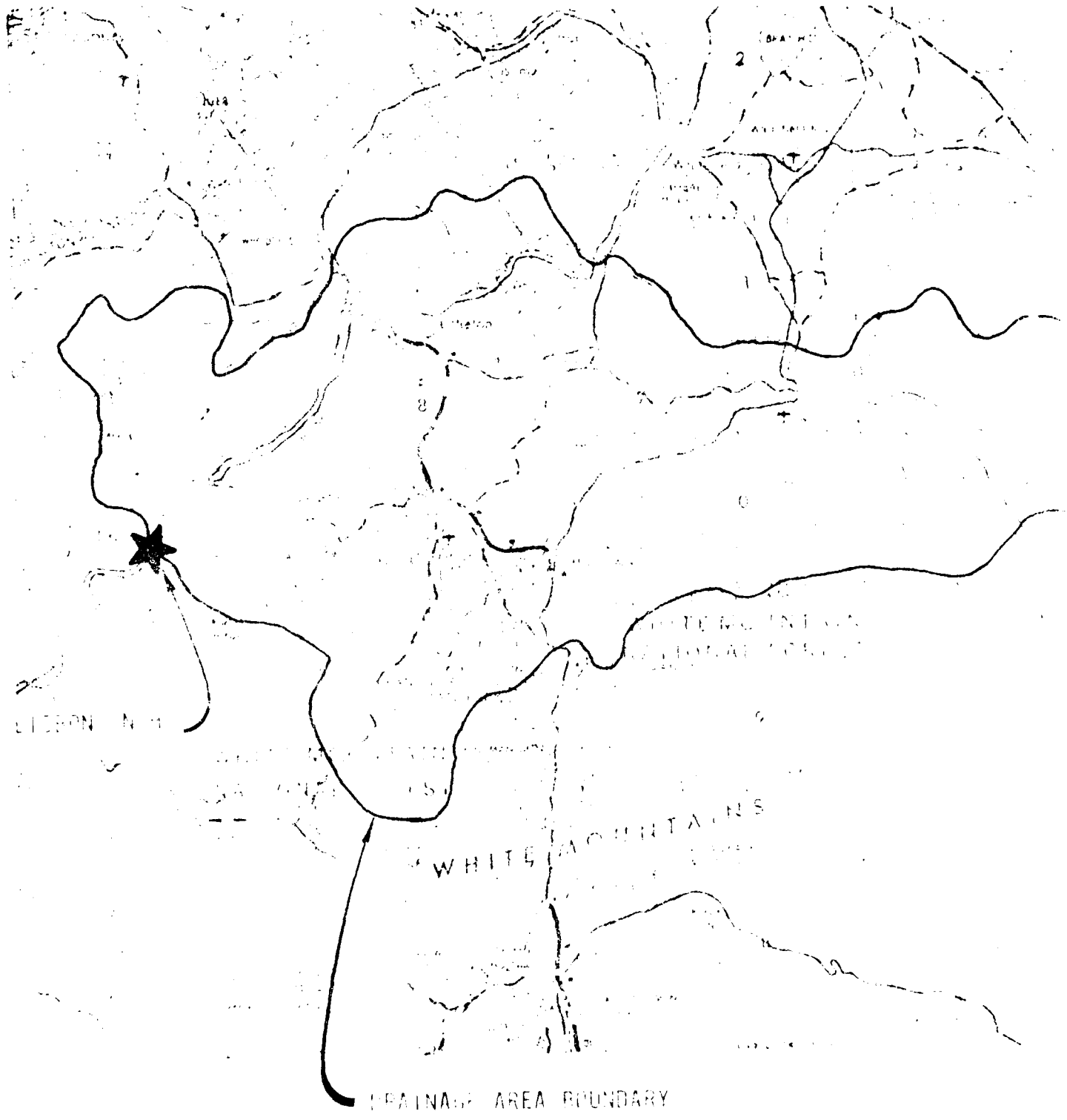
ELEVATION OF DAM





LOWER [illegible] DAM

DRAINAGE AREA



APPENDIX E

Information as Contained in the National Inventory of Dams

INVENTORY OF DAMS IN THE UNITED STATES

STATE	FEDERAL NUMBER	REVISION	STATE	COUNTY	CONGR DIST	STATE	COUNTY	CONGR DIST	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
									LOWER LISBON DAM	4412.9	7154.8	06APR79

POPULAR NAME	NAME OF IMPOUNDMENT
	AMMONOOSUC RIVER

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	DIST FROM DAM (MI.)	POPULATION
		AMMONOOSUC RIVER	LISBON NH	0	1480

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
[illegible]	1926	0	24	24	488	96	FED	N	N	N	N	06APR79

REMARKS
22=BREACHED 22=REPLACEMENT 24=UNUSED

D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
Y	300	G	228	29500												

OWNER	ENGINEERING BY	CONSTRUCTION BY
PUBLIC SERVICE CO OF NH	HOWARD M TURNER	LISBON LIGHT AND POWER

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
FED WATER RES BD	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
CORPS OF ENGRS ENG. CORPS.	15NOV78	PL92-367 AUGUST 8 1972

REMARKS

END

FILMED

8-85

DTIC